

Bridging the Gap

**Restoring and Rebuilding
the Nation's Bridges**



AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS

AASHTO
THE VOICE OF TRANSPORTATION

July 2008



Documents

Document Sharing Hub

I-35W BRIDGE COLLAPSE

AFTERMATH

NEW BEGINNINGS

August 1, 2007

The Interstate 35W (I-35W) Bridge collapses shortly after 6:00 p.m., killing 13 people and injuring 144 more.

August 2, 2007

U.S. Secretary of Transportation Mary E. Peters announces that \$5 million in federal relief aid will be made available to clear debris, set up detours, and begin repair on the bridge. She calls on all states to immediately inspect their deck-truss bridges and requests the Department of Transportation's Inspector General to assess the National Bridge Inspection Program.

August 4, 2007

Congress passes H.R. 3311 authorizing \$250 million to help rebuild the bridge.

August 6, 2007

President George W. Bush signs H.R. 3311 into law.

August 8, 2007

Addressing the National Transportation Safety Board's initial conclusions that the bridge collapse may have been caused by the weight of construction equipment and materials on the bridge, Secretary Peters directs the Federal Highway Administration (FHWA) to issue guidance strongly recommending that states ascertain that the weight of construction equipment and materials in place for ongoing or future work not exceed a bridge's load limit.

August 10, 2007

Secretary Peters advances \$50 million in emergency relief funds for recovery and cleanup costs, part of the \$250 million authorized by Congress.

August 3, 2007

Minnesota Department of Transportation (MnDOT) announces the selection of a project manager to lead the reconstruction of the I-35W bridge.

August 4, 2007

MnDOT issues a Request for Qualifications for a Design-Build Contract for the I-35W replacement project, and opens a website on the bridge collapse and subsequent rebuilding efforts.



August 23, 2007

MnDOT releases the Request for Proposal for a new bridge to five design-build teams.

August 24, 2007

MnDOT announces a series of open houses to allow citizens to comment on construction of the new bridge.

September 5, 2007

Testifying before the House Transportation and Infrastructure Committee, Malcolm Kerley, Chair of the AASHTO Highway Subcommittee on Bridges and Structures, states, "Since August 1, in compliance with federal requests, every state has reviewed or is in the process of re-inspecting its steel deck truss bridges. Based on the reports of this review, we can say that these bridges are safe."



September 10, 2007

U.S. Senator Patty Murray (D-WA), Chair of the Senate Appropriations Transportation, Housing, and Urban Development Subcommittee, adds \$1 billion to the transportation appropriations bill for bridge replacement and rehabilitation. The additional obligation limitation is passed by Congress in late December.

September 14–18, 2007

MnDOT receives four proposals from Ames/Lunda, C.S. McCrossan, Flatiron/Manson, and Walsh Construction/American Bridge.

September 19, 2007

MnDOT opens the financial proposals publicly and releases the average proposal evaluation technical scores and each team's estimated number of days to complete the new bridge.

October 5, 2007

The Minneapolis City Council and Mayor R.T. Rybak unanimously pass a resolution approving MnDOT's proposed layout for the new bridge.

October 8, 2007

MnDOT awards the \$264 million contract for construction of a new bridge to Flatiron/Manson, which agrees to complete that project no later than December 24, 2008.

October 30, 2007

House Transportation and Infrastructure Committee Chairman James Oberstar (D-MN) introduces the National Highway Bridge Reconstruction and Inspection Act of 2007, H.R. 3999, calling for strengthened bridge inspection standards and processes and increased investment in the reconstruction of structurally deficient bridges on the National Highway System

November 1, 2007

After a lawsuit opposing the bridge work is dismissed by the courts, actual construction of the new bridge starts.

November 5, 2007

"H" beam pile driving on the new bridge commences.

January 15, 2008

The National Transportation Safety Board, in an interim report, announces that an error in the original design process for the bridge led to undersized gusset plates in some of that structure's main trusses. The NTSB report Safety Recommendation H-08-1 addresses load capacity calculations for non-load-path-redundant steel truss bridges. In response, FHWA issued a Technical Advisory strongly recommending bridge owners check the capacity of gusset plates as part of the load rating calculations for existing and new non-load-path redundant steel truss bridges.

March 14, 2008

Approximately half the concrete needed for the new bridge has been poured by this date.

May 21, 2008

The Minnesota state legislature's Joint Committee to Investigate the Bridge Collapse releases its Investigative Report. It states any conclusions about the cause of the collapse are premature until the NTSB has issued its own report.

June 19, 2008

The Minnesota Department of Transportation issues a news release advising that the new Interstate 35W bridge in Minneapolis will be finished ahead of schedule. "I am pleased to announce that the I-35W Bridge project will be complete sometime between mid-September and mid-October, more than two months ahead of schedule," said Tom Sorel, Transportation Commissioner. "The project is already more than 70 percent complete." Construction crews work in 12-hour shifts around the clock, hoping to collect up to \$27 million in incentive pay for early completion.



Message from Tom Sorel

Commissioner, Minnesota
Department of Transportation



On August 1, 2007, Minnesota suffered a tragedy of historic proportions when the Interstate 35W bridge collapsed. Our hearts continue to go out to the victims, families and others affected by the collapse. And we recognize that the tragedy, although local, affected the entire nation as the safety of the nation's bridges was questioned and placed in a spotlight never before experienced.

Much has happened in this past year in Minnesota and across the country. We all await the final report from the National Transportation Safety Board on the cause of the collapse. Their findings likely will have nationwide impact in ensuring bridge safety.

The Minnesota Department of Transportation, and I am sure everyone in the transportation community, is dedicated to never letting such a disaster happen again.

Much already has been done to help restore confidence in the safety of Minnesota's infrastructure through inspection programs, gusset plate reviews and funding plans; and most notably the reconstruction of the new I-35W bridge.



We have witnessed an unprecedented spirit of cooperation to respond to and recover from this disaster. Minnesota and the nation rallied together to restore confidence, repair hearts and rebuild a bridge. We are grateful to all levels of government for their coordination and cooperation.

The accelerated rebuilding of the new I-35W bridge is evidence of this unprecedented cooperation.

As we look toward the opening of the new bridge, we remember with respect the events of one year ago and we will try to demonstrate how a resilient state and nation can indeed recover from such a tragedy.

Photo courtesy of David Gonzalez, Minnesota Department of Transportation.

Introduction



Almost a year ago, we as a nation were stunned and saddened by the tragic bridge collapse in Minneapolis that took 13 lives, injured 144 others, and disrupted the life of a great city.

In the intervening year we have watched with pride the way in which federal, state, and city transportation agencies, contractors, and construction teams have worked night and day to bring to life a new bridge, unsurpassed in technology and design.

Also in the past year we in the transportation industry have looked even more closely at the safety and sustainability of America's 590,000 bridges for today and into the future.

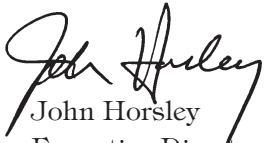
This report was developed by the men and women of the state departments of transportation to share that inside look with you.

It talks about:

- How states cope with aging bridges;
- New technologies that have advanced the science of bridge inspections;
- The life of a bridge, and how it can be extended;
- Signature bridges that symbolize America's communities;
- The truth about the resources we have to sustain our bridges, and the investment gap that must be closed.

It also relates real-life stories from Texas to Washington State about ways in which lives have been changed by the opening or closing of a bridge.

There is something about a bridge that stirs our spirits and captures our imaginations. Perhaps that is why a failure such as what happened in Minnesota is so crushing, and the resulting work toward a new beginning is so uplifting. On the anniversary of this tremendous loss, let us look forward to what America can still achieve.


John Horsley
Executive Director



Documents
Document Sharing Hub

Top Five PROBLEMS for BRIDGES

- 1. Age and Deterioration** The nation has a generation of Baby Boomer Bridges, constructed in the 1950s and 1960s, that need major repair or replacement. Usually built to last 50 years, the average bridge in this country today is 43 years old. While safe to travel, almost one in four bridges is either structurally deficient and in need of repair, or functionally obsolete and too narrow for today's traffic volumes.
- 2. Congestion** The nation cannot fix its congestion problems without fixing its bridge problems. The nation's bridges have become chokepoints on the country's freeway system, particularly at interchanges and major river crossings. The top 10 highway interchange bottlenecks cause an average of 1.5 million truck hours of delay each year. Much of the cost to improve highway interchanges is directly related to the construction of bridges and overpasses that separate and elevate lanes of traffic.
- 3. Soaring Construction Costs** The dollars available for bridges, in fact for all categories of highway and transit investment, are buying less and less in the marketplace. With oil nearly quadrupling in price in the past four years, construction costs have soared. The costs of steel, asphalt, concrete, and earthwork have risen by at least 50 percent. Thirty months of unprecedented construction inflation are forcing state officials to delay important bridge replacement projects.
- 4. Maintaining Bridge Safety** Nearly every state faces funding shortages which prevent them from applying the kind of ongoing preventive maintenance, repair, and replacement that would keep their bridges sound indefinitely.
- 5. New Bridge Needs** The staggering costs of new bridges and their related interchanges prevent many states from building the bridge mega-projects that are needed to address congestion and serve economic growth. Massive costs far outweigh available resources.

Top Five SOLUTIONS for BRIDGES

- 1. Investment** All levels of government—federal, state, and local—will have to significantly increase transportation investment if the nation is to preserve what has been built and ensure the modernization essential for future growth. A significant portion of that additional investment would be needed to improve, expand, and widen bridges on the nation's highways.
- 2. Research and Innovation** The safety, longevity, and economy of U.S. bridges are being constantly improved by innovations in design, materials, and technology. Using such advances, a new generation of safe and long-lasting bridges can be built and the life of existing bridges extended. Research on bridge design, materials, and preservation must be continued.
- 3. Systematic Maintenance** Through systematic, long-term management systems, states can produce stable conditions for the entire inventory of bridges for the lowest life-cycle cost. The goal is to find the right balance between fixing immediate problems, conducting preventive maintenance, and periodically replacing a reasonable number of old bridges to keep the health of its bridge population stable.
- 4. Public Awareness** The Minneapolis bridge collapse on August 1, 2007 was a wake-up call that focused national attention on the importance of the bridges that America takes for granted. Awareness is the first step to a national commitment to increase investment in transportation infrastructure.
- 5. Financial Options** Meeting the nation's bridge needs will require at least two forms of financing options. In metropolitan areas, where major new bridges are needed to accommodate heavy volumes of traffic, tolling can play a significant role in financing costs. In other areas, however, state and local transportation agencies will need to rely on an overall increase in tax revenues to make possible the bridge preservation investments needed.



Table of Contents

Executive Summary	
Facing the Facts about America's Bridges	1
Chapter 1	
Keeping America's Bridges Safe and Sound	9
Chapter 2	
The Struggle to Hold Aging Bridges Together	15
Chapter 3	
States Respond Quickly to Bridge Disasters	23
Chapter 4	
Scarce Resources Make for Difficult Choices	27
Chapter 5	
Inspecting and Managing the Nation's Bridges	35
Chapter 6	
Innovation Adds to Bridge Safety	41
Chapter 7	
Bridges and Congestion	49
Chapter 8	
Preserving the Past, Building for the Future	55

Executive Summary

Facing the Facts about America's Bridges

The I-10 Mississippi River Bridge at Baton Rouge.
Photo courtesy of Kian Yap, Louisiana Department of Transportation.



At the anniversary of the August 1, 2007, Minnesota bridge disaster, Americans no doubt will be wondering about the status of the nation's 590,000 bridges. Carrying hundreds of thousands of commuters and other traffic as well as much of the nation's commerce, bridges are the fundamental backbone of this country's economy. At the same time, however, bridges are so common that they melt into the backdrop of everyday life, and their importance in the functioning of our society is often overlooked.

The collapse of the Interstate 35 West Bridge in Minneapolis cost the lives of 13 people and injured 144 more. Failures such as the one in Minneapolis are extremely rare, with the majority being attributed



Documents
Document Sharing Hub

© 2008 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.



Photo courtesy of David Gonzalez, Minnesota Department of Transportation

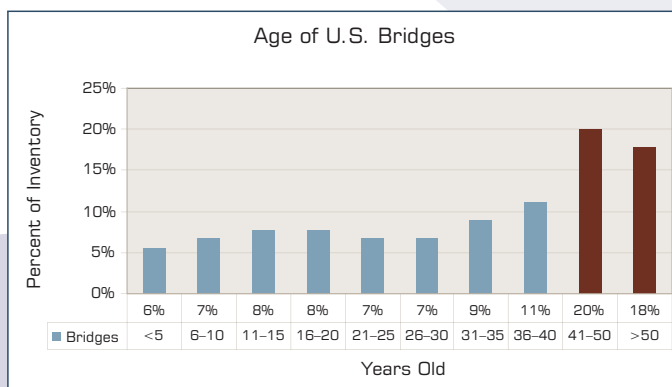
to naturally occurring events such as floods and earthquakes or man-made events such as bridges struck by barges. Rigorous state inspections combined with decades of repair have created a reliable and safe bridge system.

Aftermath and a New Beginning

Looking back at that tragic event, the response of federal, state, and local governments was remarkable. On August 2, standing with Minnesota Governor Tim Pawlenty at the site of the collapse where heroic efforts

were still underway to assist in the recovery, U.S. Department of Transportation Secretary Mary Peters announced the award of \$5 million in federal relief. She also called on all states to immediately inspect their steel deck-truss bridges, the type of structure involved in the Minnesota collapse. On August 4, Congress authorized \$250 million to rebuild the bridge. That same day Minnesota DOT (MnDOT) issued a Request for Qualifications for a Design-Build Contract for the I-35W replacement project.

In Congressional testimony on September 5, Malcolm Kerley, Virginia's Chief Engineer and Chair of AASHTO's Subcommittee on Bridges and Structures, reported that, "Since August 1, in compliance with federal requests, every state has reviewed or is in the process of re-inspecting its steel deck-truss bridges. Based on the reports of this review, we can say that these bridges are safe." On October 8, MnDOT awarded a \$264 million contract for construction of a new bridge to Flatiron/Manson, which agreed to complete the project no later than December 24, 2008. On June 18, 2008, MnDOT announced that the new bridge may be completed two months ahead of the promised delivery date.



Baby Boomer Bridges Show Their Age

Unfortunately, the future health of the nation's bridges is at a turning point. Usually built to last 50 years, the average bridge in this country today is 43 years old—and nearing the need for replacement. Almost one in four bridges, while safe to travel, is either structurally deficient, in need of repair, or functionally obsolete, which means they are too narrow for today's traffic volumes.

State departments of transportation are responsible for maintaining almost half of the nation's bridges. Yet even with inspections, improved materials, and ingenious repairs, nearly every state faces funding shortages that will prevent them from ongoing, stable investment in preventive maintenance, repair, and replacement. When repair is impossible, load limits and closings are the only options to ensure the public's safety, which, in turn lead to added congestion, delays, and hardships for those living at either side.

Despite the attention brought to bear on the condition of the nation's bridges as a result of the tragic collapse in Minneapolis, funding for repair, maintenance, and replacement has grown less certain. The Highway Trust Fund, which is the primary funding source for all federal aid for highways and bridges, is on the verge of massive shortfalls. Without new revenue, these shortfalls in 2010 could force a 50 percent reduction in funding below today's already inadequate investment levels.

In September 2009, the federal law that authorizes funding for the nation's transportation system will expire. During the next 15 months, discussions in Congress, the new Administration, and in the State Capitols of this nation will be focused on defining priorities and funding for the next decade of transportation needs.

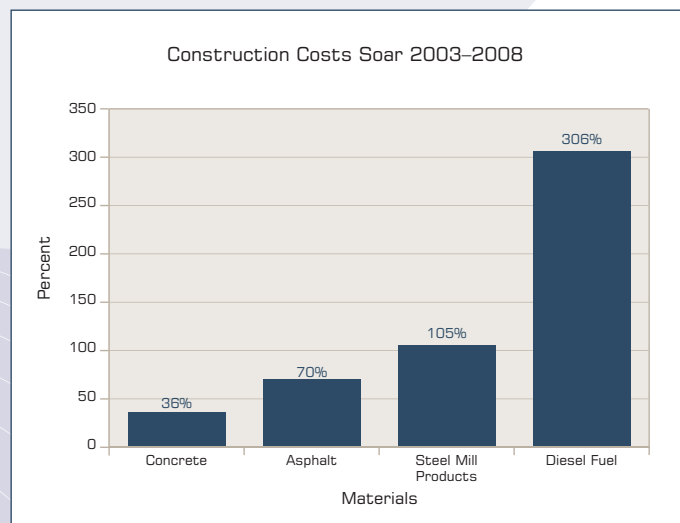
This report, *Bridging the Gap*, addresses:

- How states cope with aging bridges;
- New technologies that have advanced the science of bridge inspections;
- The life of a bridge and how it can be extended;
- Signature bridges that symbolize America's communities; and
- The truth about the resources we have to sustain our bridges, and the investment gap that must be closed.

States Simply Cannot Keep Up with Bridge Maintenance

Because the states manage the Interstate Highway System and National Highway System, more than 73 percent of *all* traffic and 90 percent of *all truck* traffic travels over state-owned bridges. The U.S. Department of Transportation's 2006 *Condition and Performance Report (C&P)*, notes that more than \$12.4 billion would be needed annually to actually improve bridge conditions on the federal-aid eligible system to a level that would help

In September 2009, the federal law that authorizes funding for the nation's transportation system will expire. During the next 15 months, discussions in Congress, the new Administration, and in the State Capitols of this nation will be focused on defining priorities and funding for the next decade of transportation needs.





Workers operate concrete pump in the building of the I-94 Business loop of Memorial Bridge North Dakota. Photo courtesy of Mike Kopp, North Dakota Department of Transportation, 2008.

relieve congestion and reduce accidents.

To address bridge needs, states use federal funds, as well as substantial funding from state and local resources. Because states consider bridge safety to be such a priority, they spend dramatically more money on bridges than is provided under the federal Bridge Program. To illustrate, in 2004 the federal Highway Bridge Program provided \$5.1 billion to the states for bridge rehabilitation. However, in that year the states spent this amount plus an additional \$1.5 billion in other federal highway aid. State and local funding added another \$3.9 billion for bridge repairs. As a result, \$10.5 billion was invested in bridge improvements by all levels of government. The U.S. DOT's C&P report concluded that if spending continued only at this level, 20 years later the backlog in needed bridge investment would remain at over \$34 billion.

At the same time, states are finding that dollars available for bridges, in fact for all categories of highway and transit investment, are buying less and less in the marketplace. With oil nearly quadrupling in price in the past four years, construction costs have soared. The costs of steel, asphalt, concrete, and earthwork have risen by at least 50 percent. Thirty months of unprecedented construction inflation are forcing state officials to delay important bridge replacement projects.

Needed: A National Commitment to Significant Investment in Transportation Infrastructure

The National Surface Transportation Policy and Revenue Study Commission estimates that the United States should be investing about \$225 billion annually for the next 50 years on all modes of transportation. Today, the U.S. is spending about 40 percent of that.

According to data from the FHWA, it would cost \$140 billion in 2006 dollars to immediately repair every bridge that is deficient in the country. Since immediate total repairs would be impossible to undertake, that cost would increase with inflation over time.

All levels of government—federal, state, and local—will have to significantly increase transportation investment if the nation is to preserve what has been built and to ensure the transportation modernization essential for future growth. A significant portion of that additional investment would be needed to improve, expand, and widen bridges on the nation's highways, its railroads, and on its dedicated transit and commuter rail lines.

All levels of government—federal, state, and local—will have to significantly increase transportation investment if the nation is to preserve what has been built and to ensure the transportation modernization essential for future growth.

The Nation Cannot Fix Its Congestion Problems Without Fixing Its Bridge Problems

The nation's bridges have become chokepoints on the country's freeway system, particularly at interchanges and major river crossings. Between 1995 and 2004 annual travel on the Interstate Highway System grew by 28 percent, at the same time that the system was expanded by only one-half of one percent. Truck travel nearly doubled in the past 20 years and is projected to double again by 2035, adding significantly more loads to the already heavily traveled bridge system.



Bridge inspector examines high beam on the I-29 Overpass at 52nd Avenue South in Fargo, North Dakota.
Photo courtesy of Terry Wiklund, North Dakota Department of Transportation, 2008.



Snooper truck inspection.
 Photo courtesy of Duluth Shipping News.

Most of the nation's traffic and the vast majority of its truck freight, travel on the nation's major routes—the Interstate Highway System, the National Highway System, and the urban freeways. The NHS represents only 4 percent of the nation's busiest roads and bridges, but carries 40 percent of all traffic and 75 percent of heavy truck traffic.

The staggering costs of new bridges and their related interchanges dwarf original construction costs. New bridges are needed to address congestion in major urban areas, but state and local officials are at a loss as to how to raise the massive amount of funds necessary for construction.

New bridges are needed to address congestion in major urban areas, but state and local officials are at a loss as to how to raise the massive amount of funds necessary for construction.

Innovation and Technology Are Adding to Bridge Safety

To ensure the safety of the nation's bridges, every state conducts a thorough and continual bridge inspection and rehabilitation program. Federal regulations require that, with some exceptions, bridges over 20 feet in length be inspected every 24 months by trained and qualified bridge inspectors. States often develop more detailed programs appropriate to unique circumstances.

Advances in technology such as electronic gauges are also enhancing the ability of inspectors to assess bridge conditions. New materials are now available for bridge building such as high-strength steel, high-performance concrete, rustproof components, and fiber-reinforced polymer composites.

The nation's departments of transportation face a frustrating contradiction. They have better engineering, materials, and construction techniques than ever before, ensuring that a new generation of safe and longer-lasting bridges can be built for the future. Without a national commitment to bridge investment, however, states will face painful trade offs to keep the nation's bridges safe and the American public moving.



Chapter 1

Keeping America's Bridges Safe and Sound



Every day Americans drive millions of miles across the country's 590,000 bridges with little thought about the structures. Bridges are so common that they melt into the backdrop of everyday life.

Supporting each of those bridges are not just piers and beams, but an entire network of engineers, inspectors, management systems, diagnostic equipment, and inspection protocols to ensure their safety.

With the anniversary of the Minnesota bridge disaster, Americans no doubt will be wondering about the safety of the nation's bridges. State departments of transportation (DOTs) devote thousands of employees and billions of dollars annually to measure, assess, maintain, and repair the nation's bridges to keep them safe and sound.



Documents
Document Sharing Hub

© 2008 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

As a result, bridge failures are extremely rare. Of the few bridge collapses in recent decades, the large majority are attributed to external events such as ship collisions or major fires, or natural disasters such as earthquakes or hurricanes. According to the National Transportation Safety Board, in the past 20 years approximately 47 deaths have been attributable to bridge failures.

To state DOTs, any fatality or any bridge failure is unacceptable. That is why they inspect their bridges, invest in new diagnostic equipment, and constantly strive to advance bridge design and materials.

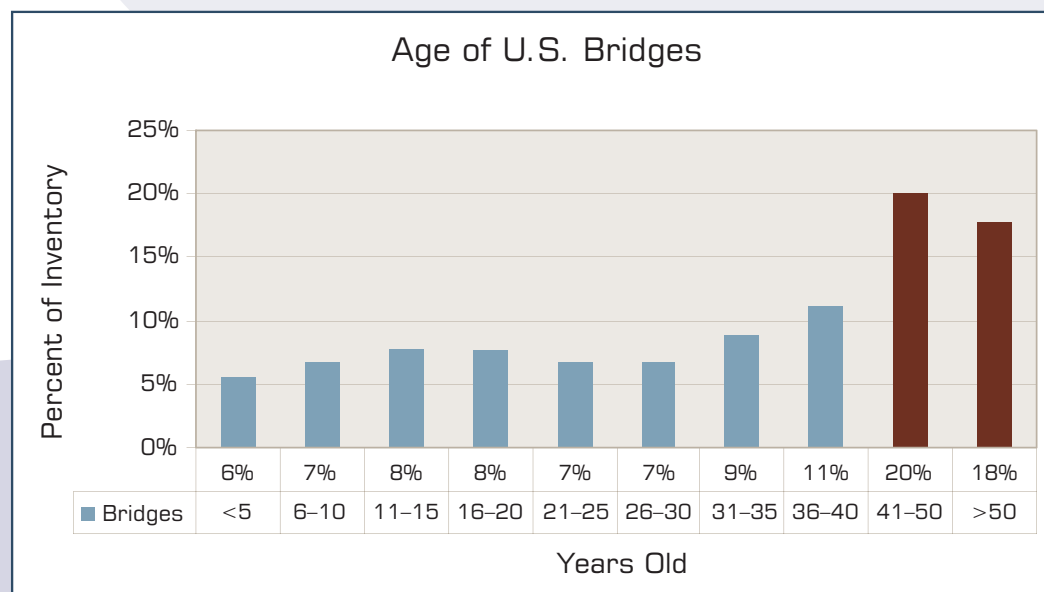
Wearing Down the Nation's Bridges

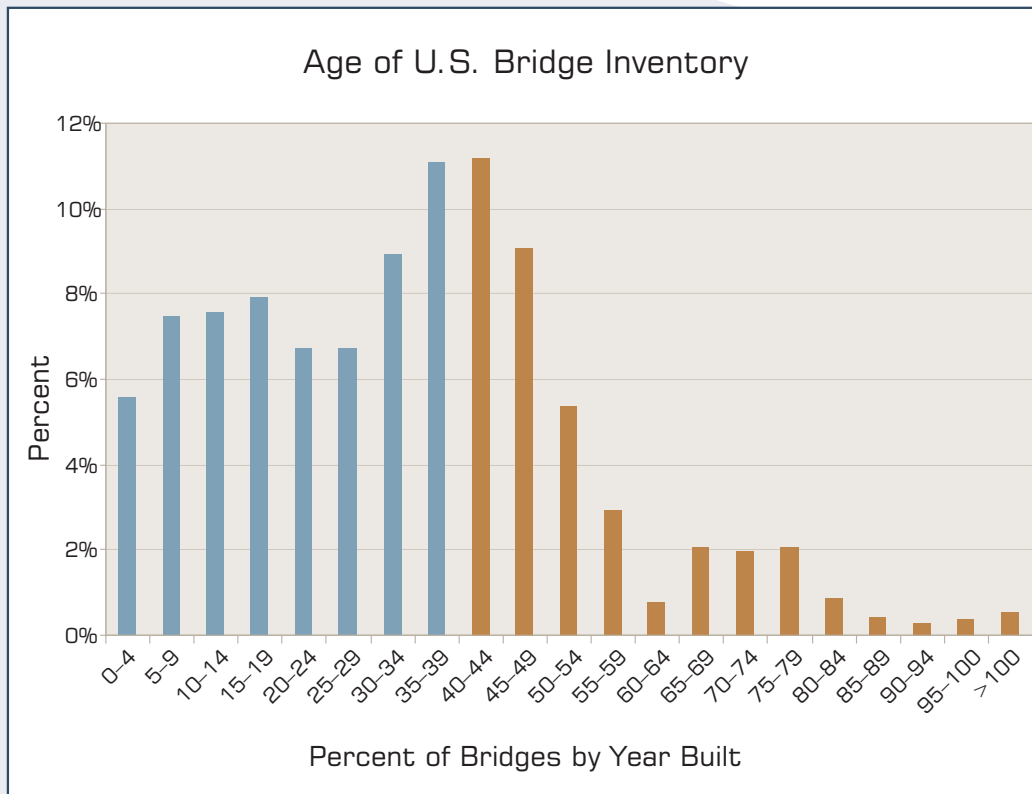
Traffic and age are two primary factors wearing down America's bridges.

On an annual basis, more than 3 trillion vehicle miles of travel occur over bridges, with 223 billion miles of that travel occurring in trucks. Truck miles have nearly doubled in the past 20 years and are projected to grow steadily, adding significantly more loads to the already heavily traveled bridge system. Overall, freight volumes will grow from 16 billion tons today to 31 billion by 2025, with trucks continuing to carry approximately 60 percent of that tonnage on the nation's highways and bridges.

The states are responsible for about 48 percent of the nation's 590,000 bridges, including nearly all of the large, complex structures. Because the states manage the Interstate Highway System and National Highway System, more than 73 percent of all traffic is on state-owned bridges, and an estimated 90 percent of all truck traffic.

Not only have traffic volumes increased dramatically, but the nation's bridges also are aging. The Interstate Highway System building boom from the mid-1950s to the mid-1970s led to the greatest bridge-building period in history. Many of those structures are approaching 50 years old and represent a sizeable need for additional investment—no matter how diligently they have been maintained.





The number of structural repairs needed on bridges increases proportionally with their age. Data from the National Bridge Inventory demonstrate how structural repair needs increase as bridges approach their 40th year. Today, about 50 percent of all bridges, when measured in terms of area, are between 35 and 55 years of age. While 50 years ago the nation faced an historic period of bridge construction, today it faces an historic period of bridge repair and reconstruction.

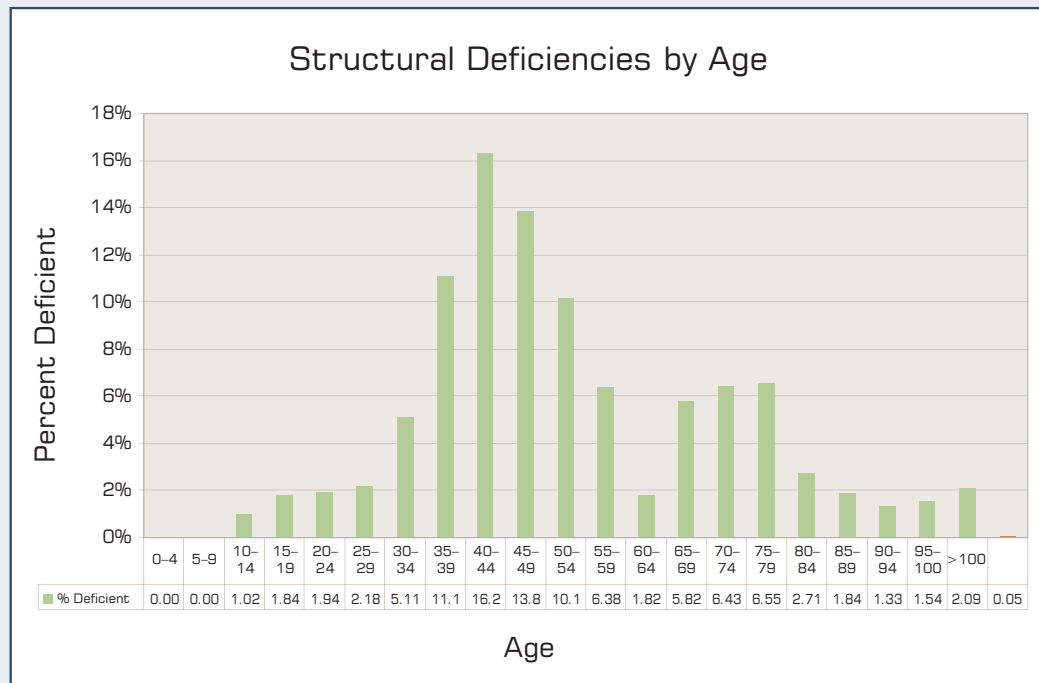
The nation's Baby Boomer bridges are showing their age. The state DOTs are keeping these bridges safe with diligent inspections, improved materials, and ingenious repairs. However, maintenance alone cannot sustain these bridges. A significant new investment and national commitment is necessary to protect these invaluable assets.

The nation's Baby Boomer bridges are showing their age. The state DOTs are keeping these bridges safe with diligent inspections, improved materials, and ingenious repairs. However, maintenance alone cannot sustain these bridges. A significant new investment and national commitment is necessary to protect these invaluable assets.

A Record of Progress Is Jeopardized by Rising Costs

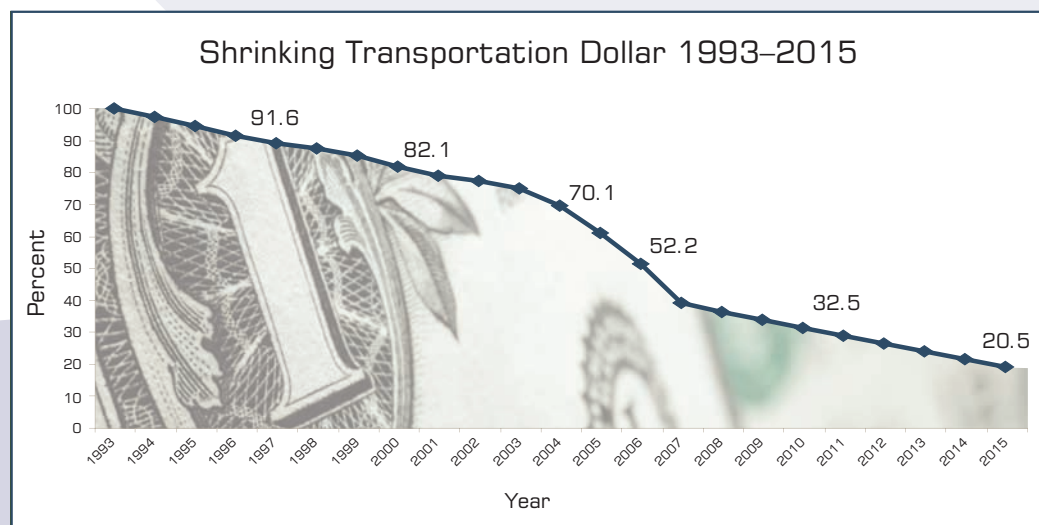
For more than a decade, the nation's departments of transportation were making steady progress on the nation's bridge inventory—at least when measured in terms of structural repairs. From 1994 to 2004, bridge conditions in both rural and



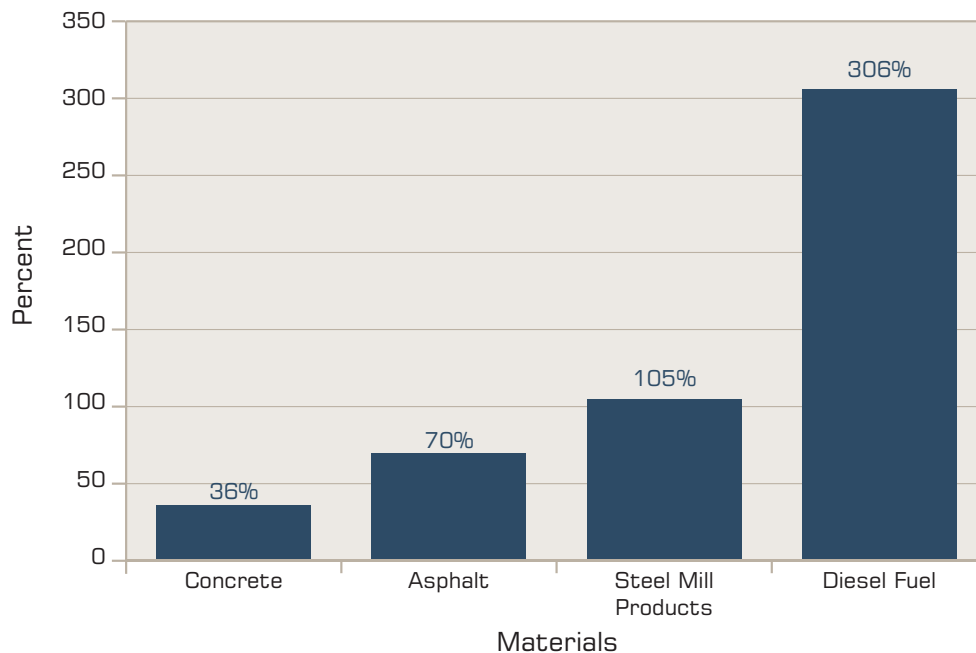


urban areas steadily improved. The U.S. DOT reported that overall deficiencies and structural deficiencies declined in every road category, although functional obsolescence has remained relatively static. In 2001, 10 percent of all the nation's bridges needed some type of structural improvement, while by 2007 that had dropped to 8.4 percent.

But this progress in improving bridge conditions is now jeopardized by unprecedented inflation in construction costs. With oil nearly quadrupling in price in the past four years, construction costs have soared. Asphalt prices have increased by 70 percent in the past five years, and diesel fuel, used for



Construction Costs Soar 2003–2008



the operation of heavy construction equipment, is up by 63 percent in only a year. Overall, the costs of steel, asphalt, concrete, and earthwork have risen by at least 50 percent. In some places, such as Hawaii, they have doubled. This has seriously eroded the states' ability to undertake planned construction projects at a time when so many bridges are in need of rehabilitation.

Summary

The nation's bridge builders have created the largest inventory of bridges in the history of the world and have done so with great reliability and safety. However, that inventory is aging at a significant rate during a time of unprecedented cost increases. How to sustain this bridge inventory at safe and satisfactory levels is a critical issue for the nation.

The nation's bridge builders have created the largest inventory of bridges in the history of the world and have done so with great reliability and safety. However, that inventory is aging at a significant rate during a time of unprecedented cost increases. How to sustain this bridge inventory at safe and satisfactory levels is a critical issue for the nation